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14. ABSTRACT

(1)---The search for invisible and crucial events. We have found [1] that the model of ballistic deposition can be interpreted as a diffusion process subordinated to ordinary diffusion. This suggests that there exist invisible crucial events. These events are unpredictable, thereby contributing an entropy increase, and enforcing a deterministic prescription on the events revealed by the experimental observation. On the basis of these results the PI' s group is developing a theory for the systematic search of invisible and crucial events. (2)---The Physics of non-Poisson processes. The original motivation for the research work, whose results are here illustrated, is the conflict between the ordinary approaches to non-equilibrium statistically physics, based on the time evolution of a bunch of trajectories, density perspective, and the approach based on the time evolution of an individual trajectory, with erratic and unpredictable jumps, trajectory perspective. Some more progresses have been done on the search for a new mathematics, suitable for the study of the spectroscopic properties of new materials, from within the trajectory perspective. We have shown [2] that the ordinary quantum like approach is inadequate to describe the complexity emerging from the behavior of new materials. A

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Report on the research activities done for Project 73209- Mathematics of Complex Dynamical Systems, second part

(1)---*The search for invisible and crucial events.*

We have found [1] that the model of ballistic deposition can be interpreted as a diffusion process subordinated to ordinary diffusion. This suggests that there exist invisible crucial events. These events are unpredictable, thereby contributing an entropy increase, and enforcing a deterministic prescription on the events revealed by the experimental observation. On the basis of these results the PI' s group is developing a theory for the systematic search of invisible and crucial events.

(2)---*The Physics of non-Poisson processes.*

The original motivation for the research work, whose results are here illustrated, is the conflict between the ordinary approaches to non-equilibrium statistically physics, based on the time evolution of a bunch of trajectories, density perspective, and the approach based on the time evolution of an individual trajectory, with erratic and unpredictable jumps, trajectory perspective.

Some more progresses have been done on the search for a new mathematics, suitable for the study of the spectroscopic properties of new materials, from within the trajectory perspective. We have shown [2] that the ordinary quantum-like approach is inadequate to describe the complexity emerging from the physics of new materials. A more appropriate mathematical tool, resting on the fractional derivatives, is used in Ref. [3]. In this paper we have shown that a new physical condition exists, termed "Living State of Matter". A physical system, with aging, seems to become intractable by means of the ordinary methods [2]. The LSM requires new mathematical tools, and the fractional derivatives, with an index determined by the systems' age, seem to be an attractive example of a new tool fitting the experimental observation.

The mathematical source for the conflict between the density and trajectory methods has been widely discussed in Ref. [4]. We have shown that the origin of the conflict is given

by the correlation functions of higher-order, whose time evolution cannot be studied without taking aging into account.

Finally, in Ref. [6] we have made theoretical predictions on the emission and absorption properties of the blinking nano-crystals, a new type of materials with intermittent fluorescence, known to fit the physical conditions for which the PI's group has developed the trajectory approach. We expect that this letter will attract the interest of experimentalists working in this field.

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